

Wildfires

Chapter 13

Learning Objectives

- **Understand wildfire as a natural process that becomes a hazard when people live in or near wildlands**
 - **Understand the effects of fires**
 - **Know how wildfires are linked to other natural hazards**
 - **Know the potential benefits provided by wildfires**
 - **Know the methods employed to minimize the fire hazard**
 - **Know the potential adjustments to the wildfire hazard**
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Introduction to Wildfire

- **Wildfires are one of nature's oldest phenomena**
 - Dating back 350 million years
 - About 20 million years ago, wildfire changed due to a change in fuel
 - New type of grass evolved which was able to sustain more frequent wildfires
 - About 11,500 years ago, after the last glaciation, when the climate warmed, wildfire behavior intensified again.
 - Part of the increase probably reflects early humans who used fire to clear land and assist in hunting.
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Introduction to Wildfire

- Before humans wildfire was ignited by lightning or volcanic eruption.
 - These fires would until they ran out of fuel or were extinguished naturally.
 - After the fire, plants would regrow from roots, spores and seeds. The cycle starts again
 - **These natural fires allowed man to capture and harness fire for heat, light, and cooking.**
 - **This allowed the human population to grow.**
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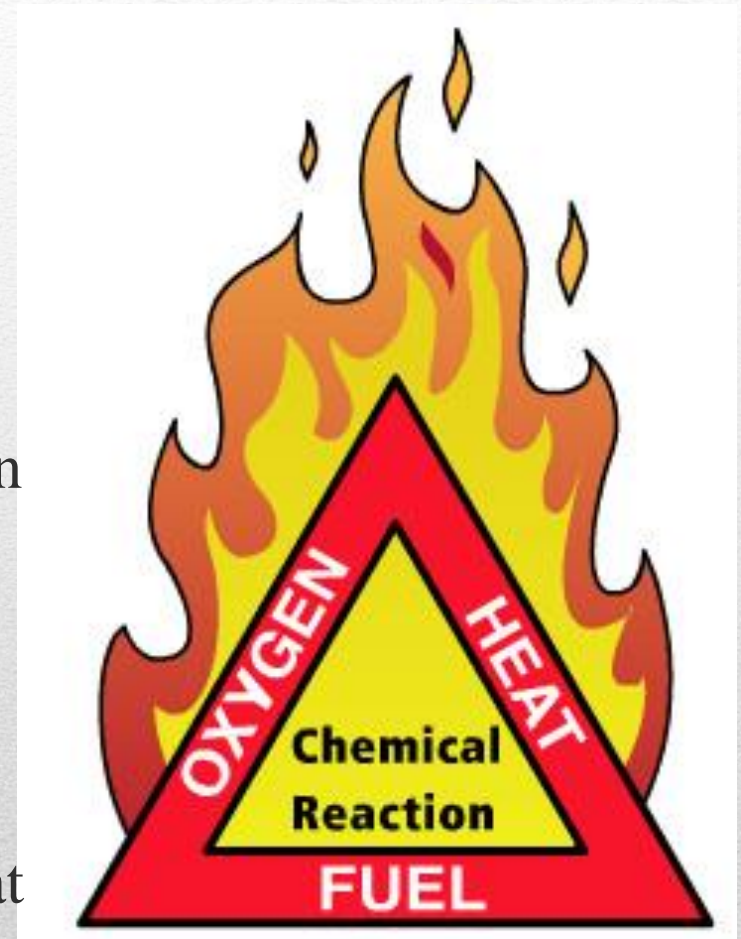


Wildfires as a Process

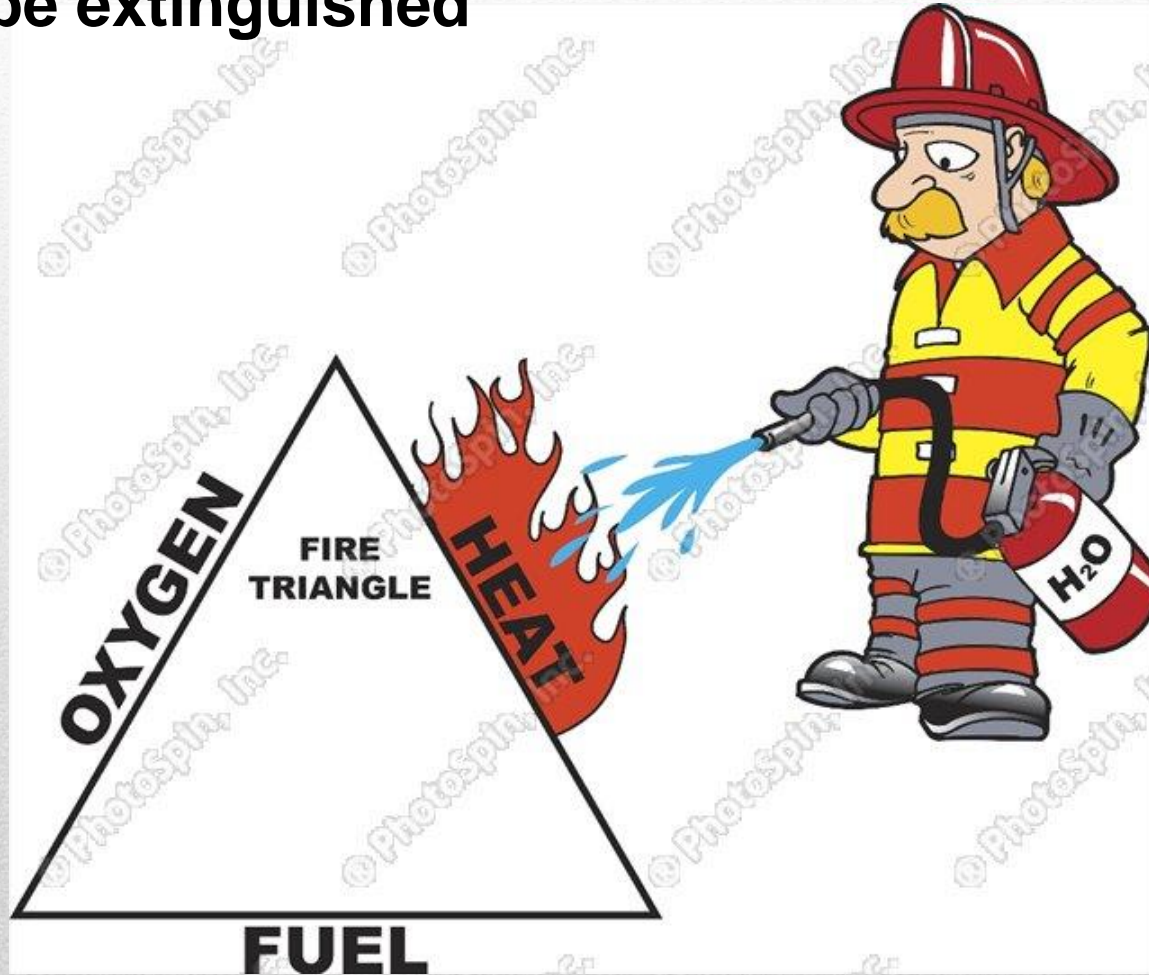
- **Wildfire is a:**
 - Self-sustaining
 - Rapid
 - High-temperature
 - Biochemical oxidation reaction
 - **Which releases:**
 - Heat
 - Light and other products
 - **This reaction requires:**
 - Fuel
 - Oxygen
 - Heat
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- **The Fire Triangle**

- **Three things** must be present at the same time to produce fire:
 - Enough **OXYGEN** to sustain combustion --
 - Enough **HEAT** to reach ignition temperature
 - Some **FUEL** or combustible material
 - Together they produce the **CHEMICAL REACTION** that is **FIRE**



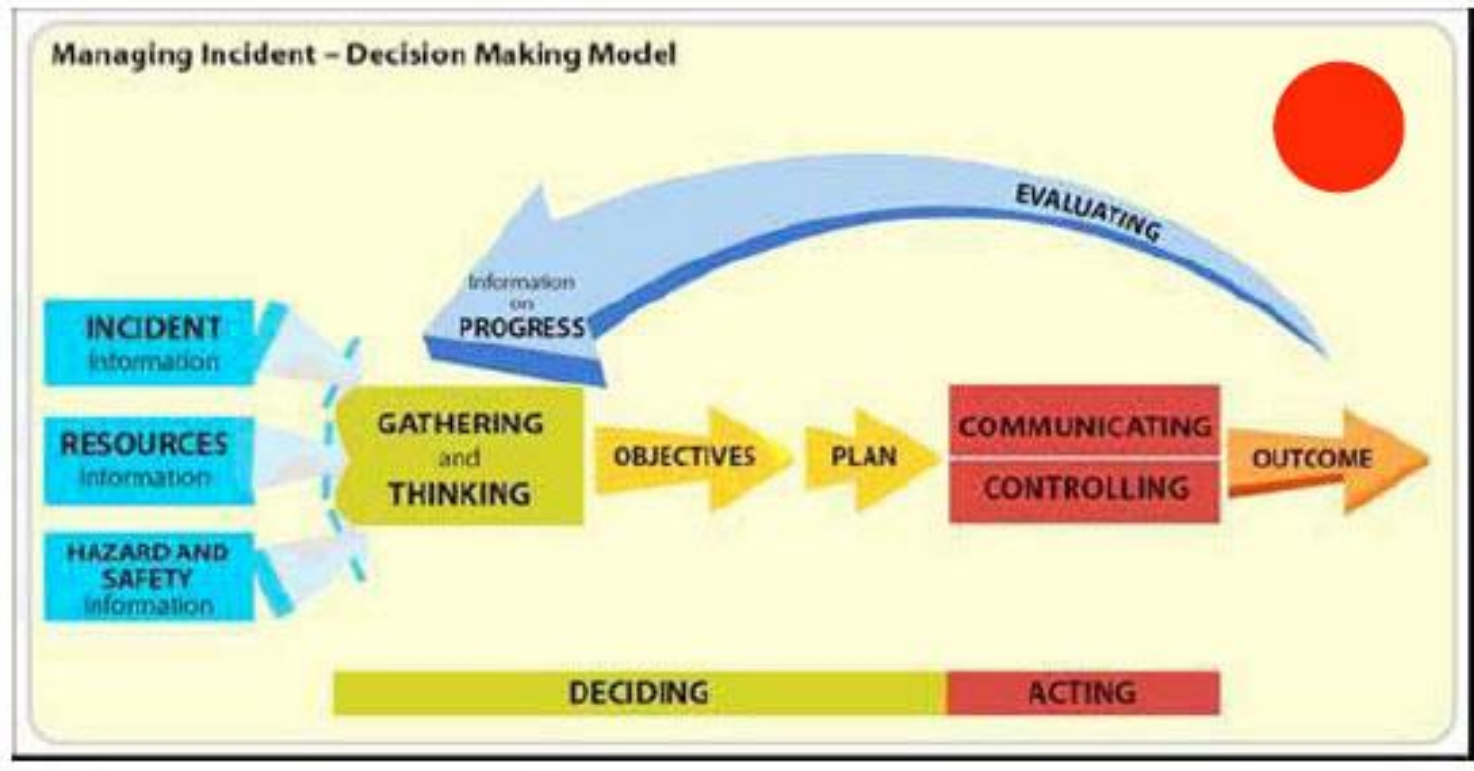
**Take away any of these things and the fire
Will be extinguished**



Phases of a Wildfire

- **Preignition – First Phase**
 - Fuel is brought to both a temperature and water content that favors ignition – two processes
 - Preheating – fuel loses a great deal of water and other volatile chemical compounds
 - Pyrolysis – chemical degradation by the heat of the fire
 - These processes combined absorb energy
 - These two processes are like scorching a piece of paper
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Wildfire Incident Command





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Phases of a Wildfire

- **Combustion – Second Phase**
 - Begins with ignition-where the process are completely different that Preignition
 - Develop when there are sufficient sources of fuel
 - This usually happens every 50 to 100 years
 - With or without humans
 - Ignition is not a single—there is usually increase in pyrolysis.
 - Two types of combustion
 - Flaming combustion
 - Smoldering combustion
 - **Extinction – Third Phase** – when one of the parts of the triangle are not present
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Wildfire Environment

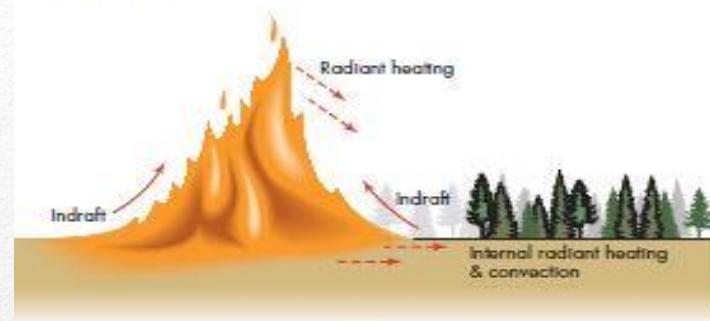
- **Fuel**

- Wildfires rely on fuel, without fuel, there is no fire.
 - Fuel consists of leaves twigs, decaying material, and peat
 - The size of the fuel can influence the ignition and movement of the fire
 - Fuel arrangement is also important
 - Drought is the last and most influential cause of wildfires
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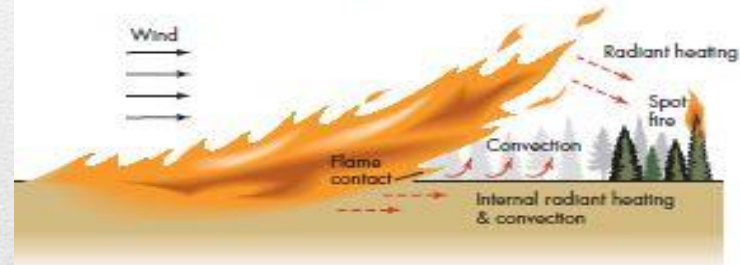
Wildlife Environment

- **Topography**

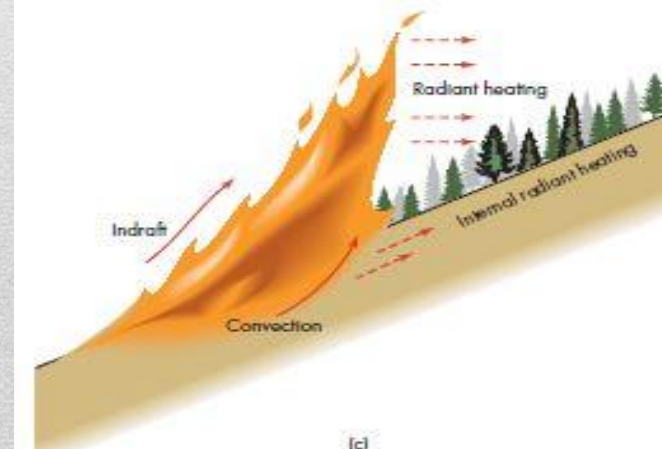
- Topography can have a profound effect on the behavior of a wildfire
 - Flat topography and no wind – fire doesn't move, internal radiant heating and convection – doesn't burn surrounding trees
 - Flat topography and wind – flames are blown direction of the wind. Possible radiant heat will start surrounding trees on fire
 - Slope and wind – both the slope and wind influence flames. Fire travels up a hill with a wind behind it.
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(a)



(b)



(c)

Wildlife Environment

- **Weather**
 - Weather has a dominant influence on the wildfire
 - Temperature, precipitation, moisture content (humidity), and winds
 - Dry thunderstorms with lighting, during the summer of a drought can be disastrous in starting wildfires
 - Wind – can help spread the embers of a wildfire over an area of very dry vegetation. This can start more fires.
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Types of Fires

- **Ground Fires** – fires that creep along slowly just under the ground surface, with little flaming and more smoldering combustion
 - **Surface Fires** – fires that move along the ground, may vary greatly in their intensity, that is, the amount of energy released
 - **Crown Fires** – fires which flaming combustion is carried through the canopies of trees.
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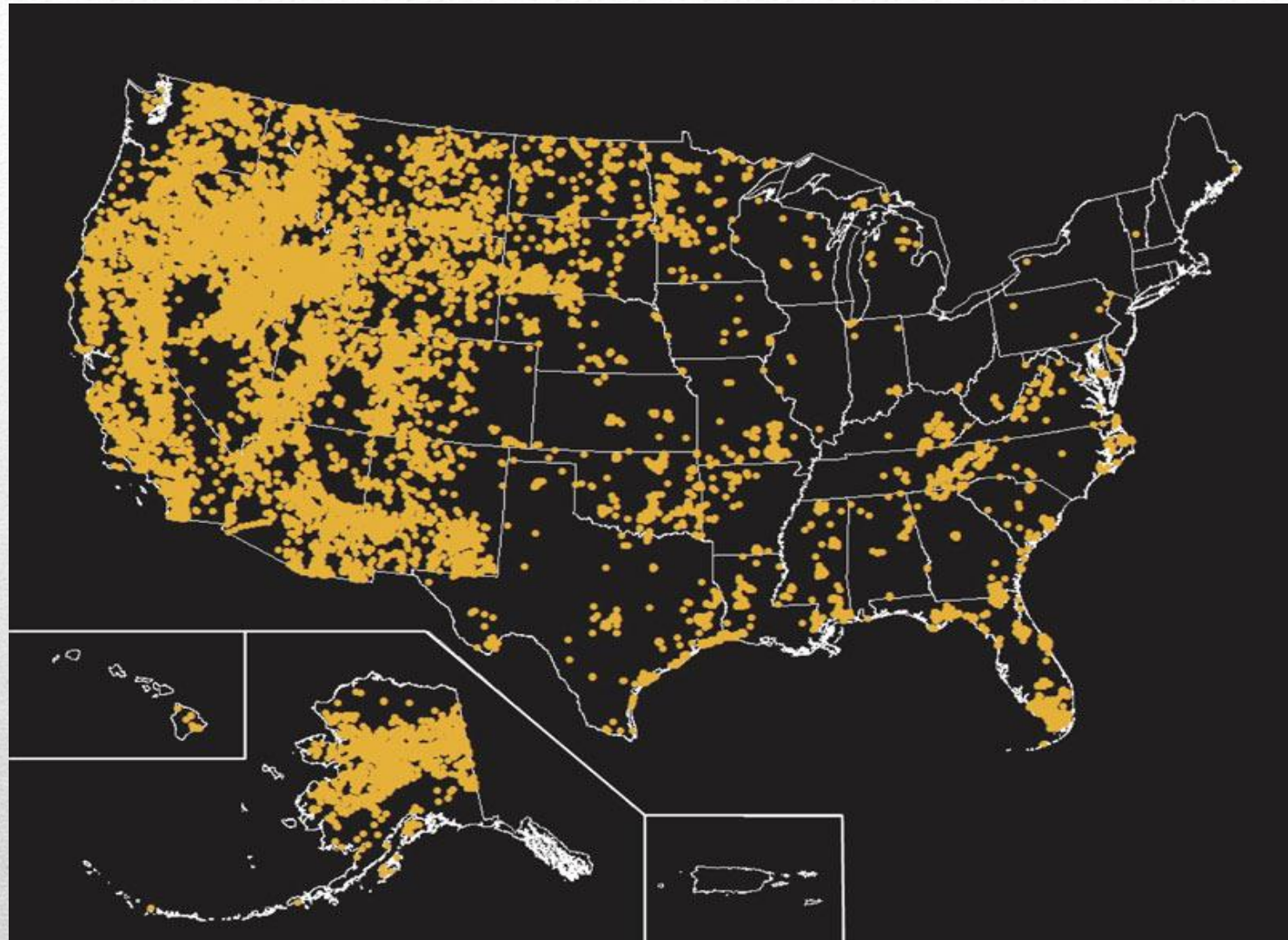


In a forest where fires rarely happen, fuel builds up: There's **surface fuel** (grass, logs, woody debris, brush); **ladder fuel** (shrubs, small trees, snags); and **tree crowns**.

- 1 Surface fires spread quickly through brush and woody debris.
- 2 Ladder fuels allow the fire to move up toward the forest canopy.
- 3 Tree crown fires are so intense, they're difficult to control.

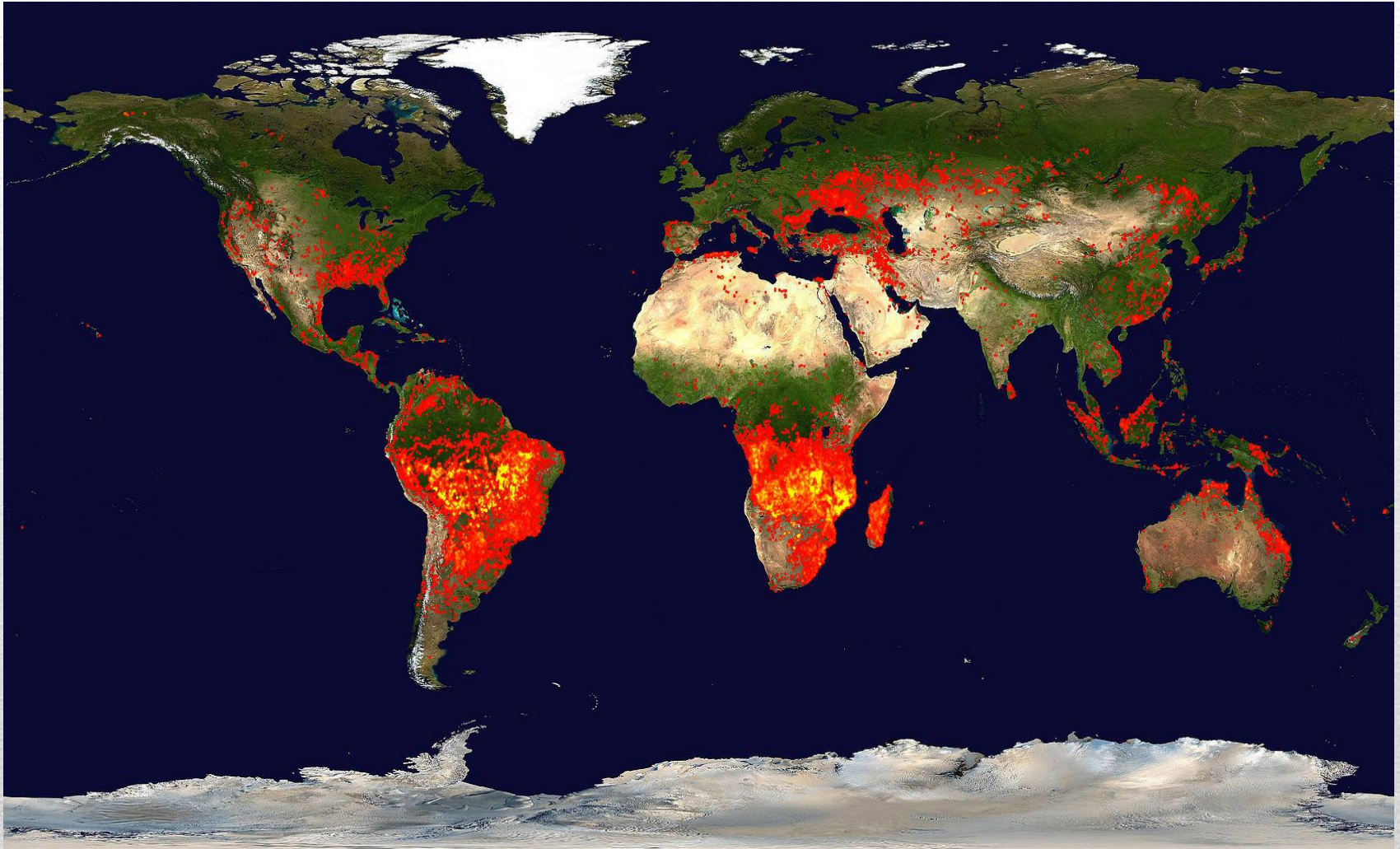
Effects of Wildfires and Linkages with other Natural Hazards

- **Wildfires affect many aspects of the local environment:**
 - They burn vegetation
 - Release smoke into the atmosphere
 - Char the Soil
 - Create favorable conditions for landslides
 - Increases erosion and runoff
 - May harm wildlife
 - **There are also effects on the overall geologic and atmospheric environments**
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Areas that experienced wildfires greater than 250 acres from 1980-2003

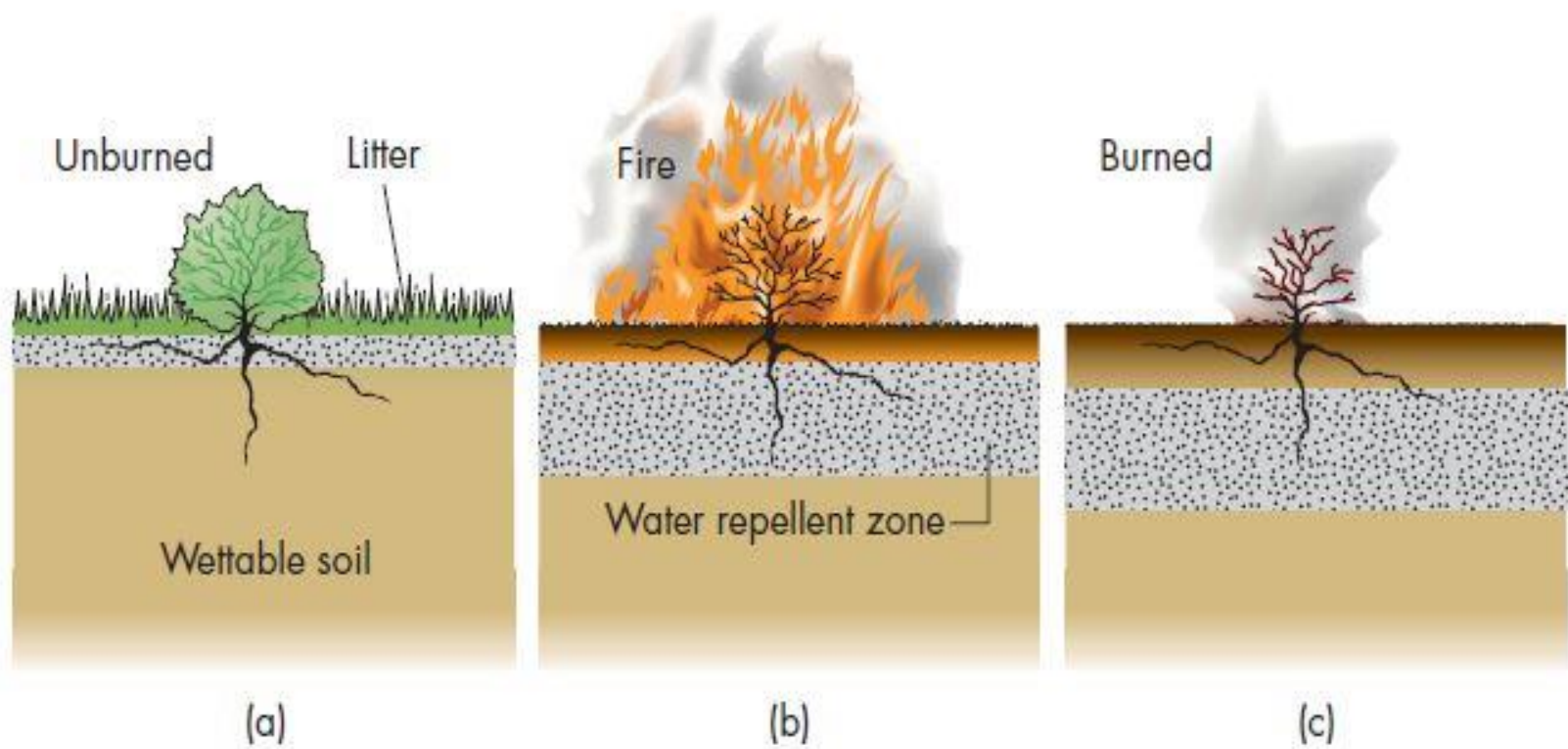
Wildfires around the world between 2/20/2011 and 3/1/2011



Red indicates low count of fire, yellow indicates high count of fires

Effects on the Geologic Environment

- Wildfires have different effects on the soils
 - Depends on the type and moisture content of soil
 - Duration and intensity of the wildfire
 - Extremely hot fires may leave a scorched dry soil
 - This soil will probably not absorb water after the fire
 - This would be called the hydrophobic layer in the soil – it is water repellant
 - This causes the soil to erode and land slides to happen
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Effects on the Atmospheric Environment

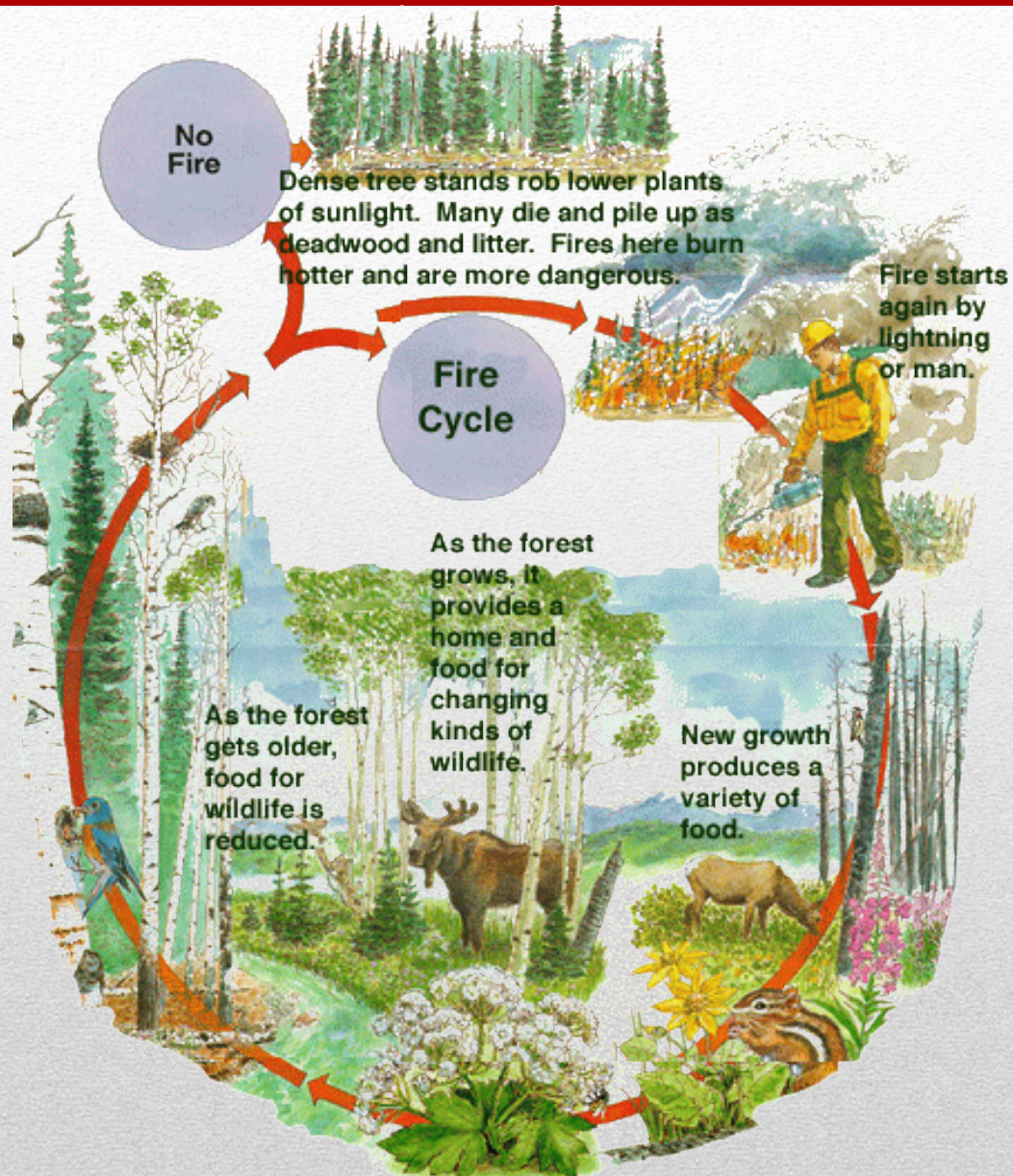
- In a short term: Wildfires create their own clouds and release smoke, soot, and invisible gases that contribute to air pollution
 - The soot and smoke increase the small particulates in the atmosphere
 - This soot and smoke can be seen miles downwind in large, long-lasting fires.
 - Wildfires also can contribute to the formation of smog with an increase in carbon monoxide, organic compounds and nitrogen oxides
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Effects on the Biological Environment

- Fires have direct and indirect effects the on the biological environment
 - These include:
 - Vegetation – numerous, varied, and complex – some plants die, some don't, some actually propagate in a fire
 - Animals – occasionally with very large fires, animals are harmed, but for the most part animals are able to avoid being harmed by wildfire
 - Humans – smoke and haze can make life difficult for humans. Humans are also have problems with lack of vegetation caused by the fire which can cause erosion
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Natural Service Functions of Wildfires

- Wildfire, although threatening to human life and property, can be beneficial to the ecosystems of the earth.
 - Benefits to the soil
 - Increase to the nutrient content of the soil and leave an accumulation of carbon on the surface in the form of carbon
 - Benefits to plants and animals
 - By reducing the number of individuals of species of plant in a given area the result may be beneficial to the plant community
 - By having a fire, a dominant vegetation may be helped by the occurrence of wildfires
 - Burning plant material recycles nutrients by quickly decomposing organic matter and allowing new plants to grow
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Minimizing the Wildfire Hazard

- Fire Management
 - Difficult because wildfires are hard to prevent
 - Not all fires need to be suppressed
 - Reasons for Fire Management
 - Science
 - Education
 - Data Collection
 - Prescribed Burns
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Minimizing the Wildfire Hazard

- Science: learn the fire regime of an ecosystem
 - The types of fuel that are found in plant communities
 - Typical fire behavior as described by fire size, intensity, and amount of biomass removed
 - The overall fire history of the of the area, including fire frequency and recurrence interval
 - Education: Public education is an integral part of fire management. (Smokey Bear, “Only you can prevent forest fires”)
 - Data Collection: Using Remote Sensing as a tool for finding areas that are dry and have fire potential
 - Prescribed Burns: Used to protect urban areas where the surrounding area is dry and could catch fire
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Perception of and Adjustment to the Wildfire Hazard

- In general, people who live or work in the wildland/urban interface do not adequately realize the risk from wildfires
 - What adjustments do we need to do to avoid the risks
 - Fire Danger Alerts and Warnings
 - Fire Education
 - Codes and Regulations
 - Fire Insurance
 - Evacuation
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TABLE 13.1

Reducing your fire hazard at home

Maintain Home Heating Systems

- Have your chimney regularly inspected and cleaned.
- Remove branches hanging above and around the chimney.

Have a Fire Safety and Evacuation Plan

- Install smoke alarms on every level of your home.
- Test smoke alarms monthly and change the batteries at least once a year.
- Practice fire escape and evacuation plans.
- Mark the entrance to your property with signs that are clearly visible.
- Know which local emergency services are available and have those numbers posted.
- Provide emergency vehicle access through roads and driveways at least 3.7 m (12 ft.) wide with adequate turnaround space.

Make Your Home Fire Resistant

- Use fire-resistant and protective roofing and materials such as stone, brick, and metal to protect your home. Avoid using wood materials, which offer the least fire protection.
- Keep roofs and eaves clear of debris.
- Cover all exterior vents, attics, and eaves with metal mesh screens having openings no larger than 6 millimeters.
- Install multi-pane windows, tempered safety glass, or fireproof shutters to protect large windows from radiant heat.
- Use fire-resistant draperies for added window protection.
- Keep tools for fire protection nearby: 30 m (100 ft.) of garden hose, shovel, rake, ladder, and buckets.
- Make sure that water sources, such as hydrants and ponds, are accessible to the fire department.

Let Your Landscape Defend Your Property

- Trim grass on a regular basis up to 30 m (100 ft.) surrounding your home.
- Create defensible space by thinning trees and brush within 10 m (30 ft.) around your home.
- Beyond 10 m (30 ft.), remove dead wood, debris, and low tree branches.
- Landscape your property with fire-resistant grasses and shrubs to prevent fire from spreading quickly.
- Stack firewood at least 10 m (30 ft.) away from your home and other structures.
- Store flammable materials, liquids, and solvents in metal containers outside the home, at least 10 m (30 ft.) away from structures and wooden fences.